PARSONS **Specification**	Project Number 732354	Specification Number 15060	Rev 0	Date 11/15/99	Sheet of 1 2

Project, Client, Location

Prime Contract F11623-94-D0024
Delivery Order RL52
Washrack Filtration System
McChord AFB, WA

Specification Title

Washrack Wastewater Unit Process Description

☐ In-House Review ☐ Client Approval ☐ Other

☐ Company Standard

☒ Entire Specification Attached

☐ Revised Sheets Only Attached

Rev	Date	By	Ck	Approvals					Remarks
				Section	Project Engineer		Client		
A	5/13/99		JW		JdG				Issued for Government Review
0	11/15/99								Incorporates design changes

This sheet is a record of each issue or revision to the subject specification. Each time this specification document is changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not a part of the specification. The revised sheets shall become part of the original specification and shall be complied with in their entirety.

SECTION II-1
WASHRACK WASTEWATER TREATMENT UNIT
PROCESS DESCRIPTION

The purpose of this section is to describe the processes and equipment required to treat the aircraft washrack wastewater to meet the Washington POTW Industrial Wastewater Discharge Limits prescribed below.

Table 1
WA POTW Industrial Wastewater Discharge Limits

Parameter	Concentration (mg/L)	
	Average	**Inst. Max.**
Arsenic	0.1	0.2
Cadmium	**0.11**	**0.22**
Chromium (Total)	1.00	2.00
Chromium (hexavalent)	0.25	0.5
Copper	1.00	2.0
Cyanide (free)	0.20	0.4
Cyanide (total)	0.64	1.28
Lead	0.40	0.8
Mercury	0.05	0.1
Nickel	1.00	2.0
Selenium	0.05	0.1
Silver	0.20	0.4
Zinc	1.00	2.0
Polar Fats, Oils/Grease (animal/ vegetable)	**Total Oil 50**	**N/A**
Nonpolar Fats, Oils/Grease (mineral/ petroleum)		**N/A**
pH	5.5 to 9.0	N/A
BOD	225	N/A
TSS	225	N/A

The treatment system selected is comprised of five steps:

Processes Outside of Skid-Mounted WWTU:

- **Equalization**
- **Carbon Canister**
- **Chemical Supply**

Skid-Mounted WWTU:

- **Reactor Chamber #1: Emulsion Breaking by Chemical Addition**
- **Reactor Chamber #2: pH Adjustment for Cadmium Precipitation**
- **Dissolved Air Flotation (DAF): Cadmium Removal and Separation of Broken Emulsion**
- **Reactor Chamber #3: Oxidation for BOD Reduction and Neutralization**
- **Reactor Chamber #4: Pump Supply and Effluent Sampling**
- **Polishing Filtration**

As indicated, process modifications will be added to an existing 7,000 gallon equalization tank (i.e., Processes Outside of Skid-Mounted Wastewater Treatment Unit (WWTU)) and new processes will be incorporated into a Skid-Mounted WWTU.

The Treatment System Flowsheet (Drawing F-1) shows the sequence of process steps. The Plot Plan (Drawing M-1) shows a general layout of the equipment in Building 1178. Each of the steps and the equipment required is described below.

Emulsion breaking testing was performed on the McChord washrack wastewater during the conceptual design phase to determine the optimum chemical dosages and residence times for separation of the oil and solids from the water. Due to recent changes in the wastewater chemistry from the introduction of a new detergent, additional treatability studies are being conducted to qualify and quantify an emulsion-breaking agent. The emulsion breaker proven successful during the conceptual design phase of this project is not effective with the new detergent employed at the washrack.

II-1.1 COMPONENTS OUTSIDE THE SKID-MOUNTED WWTU

Equalization

The existing 7000-gallon storage tank (EQ tank) is required to equalize the washwater production volumes and concentration. The trench collection and pumping system to the 7000-gallon tank will continue to operate as it does now.

Carbon Canister

The existing storage tank will require modifications to control the gaseous emissions from the tank. There is currently some concern over the need for volatile organic carbon (VOC) emission control from the tank due to current operations. The addition of a carbon filtration system and venting of the emissions to outside of the building is recommended in response to the New Regulations to Control Volatile Organic Air Emissions from Hazardous Waste in Containers (EPA Regulation 40 CFR 264/265 Subpart CC). The untreated wastewater has been initially characterized as a hazardous waste based on cadmium levels provided by McChord AFB. It is anticipated that the carbon canister will need to be changed infrequently (perhaps annually at the most). Since the VOCs have not been measured from the tank, the frequency of change out has not been calculated. The addition of a carbon filtration system is included in the scope of work.

Chemical Supply
Four (4) secondary containment pallets shall be provided for chemical feed and storage of 55-gallon drums containing: a) emulsion breaking polymer, b) sodium hydroxide, c) sulfuric acid, and d) oxidizing agent. The pallets shall be chemically compatible, immediately adjacent to the skid-mounted WWTU, and drums shall be anchored to the skid-mounted WWTU to meet requirements as specified in Section 05500.

II-1.1 SKID-MOUNTED WWTU

Pumping from the EQ tank to the new downstream equipment will be controlled by the level in the tank. A level switch will be installed in the tank at approximately the 5000 gallon mark. When the stored wastewater reaches the 5000 gallon level, a level switch will signal the Programmable Logic Controller (PLC). The PLC will start the treatment system duty Feed Pump and motor at an average flow rate of 5 gpm. If necessary, the PLC will first activate operation of the DAF for approximately 15 minutes prior to operation of the duty Feed Pump. The wastewater will be pumped into the Emulsion Breaking tank. The chemical feed pumps and DAF scraper motor will operate automatically. The emulsion breaking chemical and oxidizing agent will be dosed at a preset rate proportional to the wastewater pumping rate. The pH adjustment chemicals (NaOH and H_2SO_4) will de dosed based on the pH reading of the probe in the pH adjustment tanks and the wastewater pumping rate. A low level switch located at the 500 gallon mark will trigger the system for shutdown. A delay time of a few minutes will occur between the initial shutoff of the pumps and the remaining treatment units to allow the last portion of wastewater to be adequately treated. Note that the high and low levels associated with the 5,000 and 500 gallon mark may require level adjustment during the operation and maintenance phase to optimize operations. This setup allows the treatment system to operate for longer than the 4 hour minimum. This minimum time is required because the proposed dissolved air flotation unit (DAF) requires 15 minutes to start up and is best run in a continuous manner. Intermittent operation of only a few hours with frequent starting and stopping of the chemical addition and DAF unit will upset the system. A high level switch with an audible alarm will be installed at the 6000 gallon mark. This switch will override the 15 minute delay time triggered by the 5000 gallon switch and sound an audible alarm notifying operations personnel to monitor the volume in the tank. If necessary, on-site personnel can manually engage both the duty and standby pumps for a maximum flow rate of 10 gpm to lower the level in the tank within acceptable ranges.

Reactor Chamber #1: Emulsion Breaking
When the level in the EQ tank reaches the preset limit to initiate operation, a pnuematic valve on the discharge end of the Feed Pumps opens and the Duty Feed Pump is automatically started. Flow enters the Emulsion Breaking chamber. Emulsion Breaking or demulsifier chemical is dosed from an electronic chemical metering pump. The demulsifier is dosed automatically via an electronic controller with digital display. The chamber has a volume of 100 gallons with additional freeboard to allow a maximum residence time of 10 minutes for the demulsifier to contact all of the emulsion and provide sufficient time for blending. The reaction chamber is equipped with a mixer for blending of the tank contents. While the demulsifier will initially be dosed neat (100% strength), a chemical mix tank is provided for the preparation of diluted chemical demulsifier solutions should they be required in the future.

Reactor Chamber #2: pH Adjustment
The washrack wastewater then flows over a weir and enters the second reaction chamber for pH Adjustment. The pH is increased to 10 by addition of NaOH from an electronic chemical metering pump. The NaOH is dosed automatically via an electronic controller with digital display. The chamber has a volume of 100 gallons with additional freeboard to allow a maximum residence time of 10 minutes (at the maximum flowrate of 10 gpm) for the cadmium hydroxide and other metal hydroxides to precipitate out of solution. The reaction chamber is equipped with a mixer for blending the tank contents. The cadmium comes out of solution and the emulsion continues to break in this chamber.

Dissolved Air Flotation: Separation of Broken Emulsion
Following the emulsion breaking and pH adjustment stages, the washrack wastewater flows to the DAF unit for separation of the floating solids from the water. A portion (50%) of the clean effluent is recycled and supersaturated with air, mixed with the washrack wastewater influent and injected into the DAF separation tank. The dissolved air comes out of solution producing millions of microscopic (30 to 120 micron in diameter) bubbles. These bubbles attach to oil and solids, floating them to the surface where they are skimmed and removed from the tank.

An average of 3% to a maximum of 5% of the influent washrack wastewater is expected to be removed as floated solids, in the form of a sludge. Based on a weekly treatment of 6000 gallons of washrack wastewater, 300 gallons of floated solids will be the maximum amount of sludge produced per week. The floated solids are pumped from the DAF to a float/sludge holding tank outside of the Skid-Mounted WWTU. Due to the expected cadmium content of the floated solids (about 20 ppm), the sludge may be considered a hazardous waste. A certified waste hauler will periodically remove the sludge. Representative sludge samples will be analyzed and profiled by McChord AFB following startup and normalized operation of the WWTU to determine the proper manifesting and off-site management of the sludge.

A typical DAF system is comprised of the following sections:

Float/Separation Chamber: The mixed washrack wastewater enters this chamber where separation and flotation occur. The separation chamber includes the float storage chamber, float baffle, water baffle with adjustable water weir, settlable sludge hopper, surface float skimmer, clean water effluent chamber and the skim ramp.

Float Storage Chamber: The skimmer continuously skims float from the water surface and conveys it up the skimramp and deposits it in the float storage chamber. The storage chamber is provided to allow temporary floated solids storage. The chamber has sloped sides to allow the solids to slide to the bottom of the sludge outlets. The floated solids are pumped from the temporary storage chamber to a storage tank. Due to the cadmium content, the floated solids may be considered a hazardous waste.

Effluent Chamber: The waste flow and floated solids run into the float baffle at the effluent of the tank. The float is contained while the water is directed under the baffle and over the

adjustable weir plate. The clean water accumulates in this chamber where a portion is recycled to the air dissolving tank and the remainder is discharged to the final neutralization tank.

Sludge Hopper: A sludge hopper is located under the separation chamber to provide storage of any settlable solids.

Surface Float Skimmer: A mechanical surface drag skimmer assembly is provided to sweep the floating solids from the effluent end of the separation chamber toward the influent end. The skimmer consists of skimmer flights and blades, flight chain, sprockets, variable speed drive, sprocket shafts, bearings, and chain adjustable bearing frames.

The DAF unit is provided with an air saturation system that is designed to take water from the effluent chamber, supersaturate the water with air, and then mix this solution with the incoming washrack wastewater. The air saturation system is comprised of the following units:

Recycle Pump: A pump is mounted on the DAF skid to provide water for air saturation.

Influent Mixing Chamber: The saturated flow mixes with the washrack wastewater flow at the DAF influent via a "Y" connection and a back pressure control valve locate on the recycle line prior to the Y junction for fine control of mixing.

Reactor Chamber #3: Oxidation and Neutralization

In recent treatability tests, the BOD content of the clarified washrack wastewater has been above discharge requirements for the sanitary sewer. The BOD must be reduced to within the 225 mg/L limit. In order to optimize the use of equipment on the skid-mounted unit, both the final oxidation and neutralization will occur in this chamber. Oxidation agent will be dosed to reach a target BOD of 150 mg/L BOD.

The pH of the clarified washrack wastewater must be decreased to meet the discharge requirements of 5.5 to 9.0. The washrack wastewater flows by gravity from the DAF unit to the neutralization tank. Acid is dosed from an electronic chemical metering pump to a target pH of 8. The tank has a volume of 100 gallons plus freeboard to allow a residence time of 10 minutes at maximum flow conditions for the acid and oxidizing agent to contact all the washrack wastewater. The tank is equipped with a mixer for blending of the tank contents.

Reactor Chamber #4: Pump Supply and Effluent Sampling

The washrack wastewater then flows over a weir and enters the final reaction chamber, pump supply/effluent sampling. The purpose of this chamber is to provide a sampling point to confirm that the treated water meets the discharge requirements and a water reservoir for pumping to sanitary sewer and into the polishing filter, if necessary. The tank has a volume of 100 gallons plus freeboard. This chamber will also add flexibility to the system in case there is a need for additional chemical treatment prior to discharge in the future.

Polishing Filter

The washrack wastewater, sampled in the final chamber, shall meet the discharge requirements and be discharged to the sewer by pumping treated effluent to Sewage Pumping Station 82029

approximately 60 feet west of Building 1178. A polishing bag filter is included downstream of the Pump Supply/Effluent Sampling chamber to remove suspended solids if upset conditions should occur in upstream equipment and sufficient separation does not occur in the DAF unit. The polishing filter will normally be by-passed by setting valves in the discharge line. If upset conditions occur, the valve to the bag filter would be opened and the wastewater would pass through the 15-micron bag filter prior to discharge to the sewer. Upset conditions include:

1. Excessive contaminants in the wastewater: this treatment system has been designed to treat wastewater with the characteristics determined by sampling and analysis (given in Table 2). If the characteristics change greatly, (for example, to 10,000 mg/L oil and grease or 1 mg/L lead), the treatment system will require adjustment.
2. Equipment malfunctions: If a mixer in a chemical treatment tank or the chemical injection pump doesn't run properly, the wastewater will not be treated adequately for discharge.

Upset conditions are monitored by visual inspection by the operator and by analysis of the influent and effluent wastewater.

Table 2
Untreated Washrack Wastewater Quality

Parameter	Concentration Range (mg/L)
Arsenic	ND (<0.05)
Cadmium	0.44-**1.28**
Chromium (total)	0.061-0.27
Copper	0.146-0.27
Cyanide (total)	0.15
Lead	0.048-0.089
Mercury	0.0002
Nickel	0.055-0.069
Silver	0.0137-0.018
Zinc	0.82-0.895
Polar Fats, Oils/Grease (animal vegetable origin)	40-**483**
Nonpolar Fats, Oils/Grease (mineral petroleum)	**260-6090**
pH	6.91-7.88
BOD	**1700-5000**
TSS	25-**2800**

Bold = Represents wastewater constituents that exceed the regulatory limit.